Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

B.E. Sem-IV Examination June- 2010

Subject code: 140201

Subject Name: Mechanics of Deformable Bodies

Date: 18/ 06 /2010 **Time 10:30am to 1:00 pm**

Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Select most appropriate answer from given option and rewrite the complete sentence **05**

(1) Macaulay's Method is most suitable for finding out slop & deflection of beam carrying _____ loading
(a) Symmetrical, (b) Unsymmetrical, (c) Inclined

(2) For simply supported beam carrying a central point load W, the maximum deflection is _____.
(a) $Wl^3/16EI$, (b) $Wl^3/32EI$, (c) $Wl^3/48EI$

(3) When a shaft diameter d is subjected to Combined twisting moment T & bending moment M, the major principal stress is _____

(a) $\frac{16}{\pi d^3}(M + (M^2 + T^2)^{1/2})$

(b) $\frac{16}{\pi d^3}(M + (M^2 - T^2)^{1/2})$

(c) $\frac{16}{\pi d^3}(M - (M^2 + T^2)^{1/2})$

(4) A welded joint as compared to riveted joint has _____
(a) less strength, (b) more strength, (c)same strength

(5) In curved beam, the stress is zero at _____
(a) Centroidal axis (b) Neutral axis, (c) bottom face

(b)
1. Explain the theory of pure torsion & Torsional moment of resistance. **03**
2. Explain the limitation of Euler's theory. **02**
3. Explain core or kernel of the section. **02**
4. Write the Castigliano's 1st theorem **02**

Q.2 **(a)**
(1) Design the solid shaft which will transmit 350kW at 210 r.p.m the maximum shear stress should not exceed $40N/mm^2$ and twist should not be more than 1.5 degree in a shaft length of 2.5 m. Take modulus of rigidity = 1×10^5 N/mm^2. **04**

(2) A Circular shaft of 85 mm diameter subjected to a bending moment of 6 kN.m and twisting moment of 7kN.m so Determine principal stress and plane on which they act. **03**

(b)
(1) Draw the neat sketch of varies types of riveted joint. **03**

(2) Find the efficiencies of the double riveted lap joint for 10mm thick plates with finished diameter of rivets 19.5mm at a pitch of 75mm centres. If the allowable tensile stress 150 N/mm^2, bearing stress 300 N/mm^2,and shearing stress 100 N/mm^2 **04**

OR

(b)
(1) Enlist the advantage of riveted connection and welded connection. **03**

(2) A single riveted double cover butt joint in plate 14mm thick is made with 21.5mm finished diameter rivets at a pitch of 90mm. If the allowable tensile stress 150 N/mm^2, bearing stress 300 N/mm^2, and shearing stress 100 N/mm^2. Find the efficiency of the joint. **04**

Q.3 **(a)** (1)A hollow rectangular column as shown in **fig. 1** is 10 cm thick. Calculate the stress at each outer & inner corner of the column if a vertical load P =250kN is acting with an eccentricity ex = 300mm & ey = 200mm. **05**

(2)A Masonry Dam 6m high, 1m wide at top & 3m wide at the base has its water face vertical & retains water to a depth of 5m. calculate the maximum and minimum stress induced at the base if the unit weight of masonry & water are respectively 22 kN/m^3 and 9.8 kN/m^3 **04**

(b) A hollow cylindrical cast iron column 2m long with both ends hinge. Determine the external and internal diameter of column if it has to carry crippling load 1300 kN. Take internal diameter as 0.8 times the external diameter. Take crushing stress 550 Mpa & Rankine's constant 1/1600 **05**

OR

Q.3 **(a)** (1) A Masonry Chimney 19m high of circular section, the external & internal diameter 6.5 m & 3.5m respectively. The chimney is subjected to a horizontal wind pressure 1550 N/m^2 of projected area. Find maximum & minimum stress intensities at base. Take the weight of masonry 21 kN/m^3 **05**

(2) A short column of rectangular section is subjected to load as shown in **fig.2** Find combined stress at each corner of the column also draw the stress diagram. **04**

(b) A bar of length 4.5m, when used as simply supported beam & subjected to uniformly distributed load of 20kN/m over the whole span, deflect 15mm at centre. Determine the crippling load when it is used as a column with following condition (1) Both ends fixed, (2) Both ends hinged, (3) one fixed and other end hinge. **05**

Q.4 **(a)** (1) A beam of square section is subjected to uniform bending moment 700 N.m If the cross section the beam is 50mm x 50mm. Find maximum & minimum stress for the following cases (a) The beam is straight and (b) The beam is curved to a radius of 200mm along the centroidal axis and bending moment increases the curvature and also find position of Neutral axis. **06**

(2) A hook of circular section 30mm diameter and radius of curvature of its central axis also 30mm caries a load of 5kN. Calculate the maximum tensile & compressive stress in the hook. Also locate the neutral axis. **05**

(b) Explain unsymmetrical Bending **03**

OR

Q.4 **(a)** (1) Locate the position of neutral axis and Determine Maximum & Minimum stress when a curved beam of trapezoidal section of bottom width 25mm, top width 35mm and depth 40mm subjected to pure bending moment 650N.m the top width is towards the centre of curvature. The radius of curvature is 50mm and beam is curved in a plane parallel to depth. **06**

(2) A closed ring of mean radius 130mm is subjected to a pull of 25kN, the line of action of which passes through its centre, the ring is circular in cross section with a radius equal to 45mm. Find the maximum tensile & compressive stress in the ring. **05**

(b) Explain shear centre with sketch **03**

Q.5 **(a)** (1) Explain the relation between slope, deflection and radius of curvature. **03**

(2) A simply supported beam of length 6m carries a point load of 20kN at a distance of 4m from the left end as shown in **fig 3**. If $E=2x10^8$ kN/m^2 and $I = 10^{-4}$m^4. Determine the slope at the left support & deflection under the point load by using conjugate beam method. **05**

(b) A simply supported beam of length 5m and carries a two point load 50kN & 40kN at a distance of 1m & 3m respectively from the left support as shown in **fig 4.** Find the slop at supports and deflection under point load by using Macaulay's method. Take $E=2x10^8$ kN/m^2 and $I= 85x10^{-6}$m^4. **06**

OR

Q.5 **(a)** (1) Give the relation between actual beam & conjugate beam. **03**

(2) A simply support beam of length 5m carries a point load of 100kN at centre of the beam as shown in **fig5.** Find slop at supports & deflection under the point load by using conjugate beam method. **05**

Take $E =2x10^8$kN/m^2 and $I =10^{-4}$m^4

(b) Determine slope at support and central deflection of beam as shown in **fig 6** by using Macaulay's method. Take $E=2x10^8$ kN/m^2 and $I= 4.3x10^{-4}$m^4. **06**

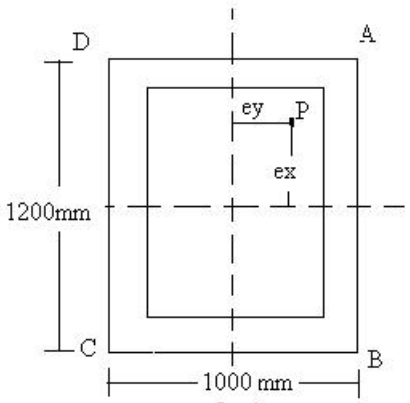

fig. 1

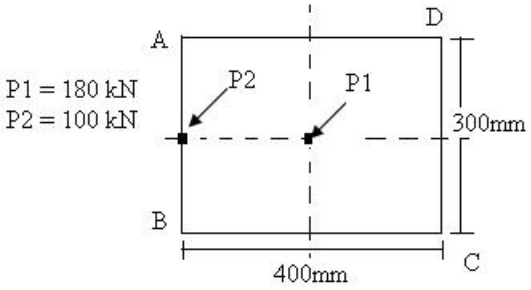

fig. 2

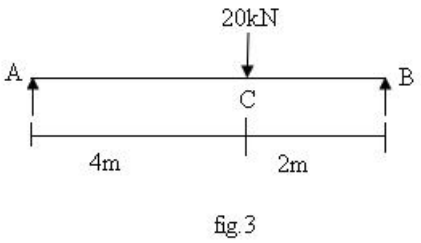

fig.3

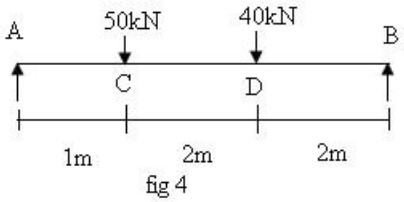

fig 4

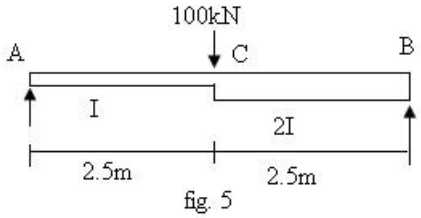

fig. 5

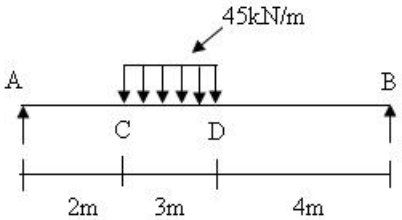

fig. 6